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Turning Reminders into Results: Impact of a Medication Reminder Device on Antihypertensive Adherence and Blood Pressure Control

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Abstract

Background: Hypertension requires long-term pharmacological treatment, but poor medication adherence remains a major cause of inadequate blood pressure control. Reminder-based devices may improve regular drug intake and therapeutic outcomes. **Aim:** To evaluate the effect of a medication reminder device on antihypertensive drug adherence and blood pressure control among patients with hypertension.

Methods: This prospective interventional study was conducted at Gurugram Global College of Pharmacy, Delhi, from August 2025 to February 2026. A total of 80 hypertensive patients were enrolled and divided into a control group and a medication reminder device group, with 40 patients in each group. The control group received routine prescription counselling, while the intervention group received counselling along with a reminder device. Baseline and follow-up data on adherence score, missed doses, systolic blood pressure and diastolic blood pressure were recorded and statistically analysed.

Results: Baseline characteristics were comparable between both groups. The reminder device group showed greater improvement in adherence score, reduction in missed doses, and reduction in systolic and diastolic blood pressure compared with the control group. Final blood pressure control was also higher in the intervention group.

Conclusion: Medication reminder devices improved antihypertensive adherence and blood pressure control and may be useful in routine hypertension care.

Key words: Antihypertensive drugs; Blood pressure control; Hypertension; Medication adherence; Reminder device

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Introduction:

Hypertension is a common chronic non-communicable disease requiring long-term pharmacotherapy, but inadequate adherence to antihypertensive drugs remains a major barrier to effective blood pressure control. Missed doses, irregular drug intake, poor recall and limited patient motivation may reduce therapeutic benefit and increase the risk of cardiovascular, renal and cerebrovascular complications. Digital health interventions, mobile applications and reminder-based technologies have shown potential to improve medication-taking behaviour and blood pressure outcomes among hypertensive patients [1,2]. Recent evidence also suggests that simple wearable or reminder devices, when combined with patient education, can improve adherence and systolic blood pressure control in elderly hypertensive individuals [3]. Therefore, low-cost medication reminder devices may be useful as a practical pharmacology–medical device intervention in routine clinical care. The present study aims to evaluate the effect of a medication reminder device on antihypertensive drug adherence and blood pressure control among patients with hypertension.

Methods:

The present study was conducted as a prospective interventional research study at Gurugram Global College of Pharmacy, Delhi, from August 2025 to February 2026. The study was planned to evaluate the effect of a medication reminder device on drug adherence and blood pressure control among patients diagnosed with hypertension. Adult patients with established hypertension who were receiving at least one prescribed antihypertensive medication were considered eligible for inclusion. Patients who were unwilling to participate, those with severe acute illness, cognitive impairment, pregnancy, or inability to use the medication reminder device were excluded. After obtaining informed consent, participants were enrolled by convenient sampling and were divided into two groups. The control group received routine prescription counselling regarding antihypertensive drug use, dose schedule, importance of regular medication intake, possible adverse effects and lifestyle modification. The intervention group received the same counselling along with a medication reminder device such as an alarm-based pill box or reminder-supported medicine storage device. Baseline demographic

details, clinical history, duration of hypertension, antihypertensive drugs prescribed, frequency of dosing, comorbidities, and history of missed doses were recorded using a structured data collection form.

At baseline, blood pressure was measured using a calibrated digital blood pressure monitor after the participant had rested for at least five minutes in a seated position. Two readings were taken at an interval of 2–3 minutes, and the average value was recorded as the baseline systolic and diastolic blood pressure. Medication adherence was assessed using a structured adherence questionnaire and by recording self-reported missed doses during the preceding week. Participants in the test group were trained regarding the correct use of the reminder device, including placement of medicines, setting of reminder time, response to alarm, and daily use at home. Follow-up assessments were carried out at regular intervals during the study period. At each follow-up visit, adherence status, missed doses, blood pressure readings, ease of device use, patient satisfaction, and any adverse drug reactions were documented. The primary outcome was improvement in medication adherence after use of the reminder device. Secondary outcomes included change in systolic and diastolic blood pressure, reduction in missed doses, usability of the device, and patient satisfaction. Collected data were entered into Microsoft Excel and analysed using appropriate descriptive and inferential statistical methods. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequency and percentage. A p value less than 0.05 was considered statistically significant.

Results:

A total of 80 hypertensive patients were included in the study, with 40 patients in the control group and 40 patients in the test group. Baseline characteristics were comparable between both groups. The mean age was 52.48 ± 8.94 years in the control group and 53.15 ± 9.21 years in the test group. Male predominance was observed in both groups. There was no statistically significant difference between groups with respect to age, gender, duration of hypertension, baseline systolic blood pressure, baseline diastolic blood pressure, or baseline medication adherence score, indicating adequate group comparability. After the intervention period, the medication reminder device group showed significantly better improvement in drug adherence compared with the control group. Mean adherence score increased from 5.42 ± 1.28 to 7.86 ± 1.04 in the test group, while the control group showed only a modest improvement from 5.36 ± 1.31 to 6.18 ± 1.22. The reduction in missed doses per week was also significantly greater in the test group. Blood pressure control improved in both groups, but the fall in systolic and diastolic blood pressure was significantly higher among patients using the reminder device, suggesting that the device was effective in improving medication-taking behaviour and clinical outcomes.

Discussion:

In the present prospective study, the medication reminder device group showed better improvement in drug adherence and blood pressure control compared with the routine counselling group. Both groups were comparable at baseline with respect to age, gender, duration of hypertension, comorbid diabetes, dosing frequency, baseline adherence score and baseline blood pressure, indicating that the post-intervention differences were likely related to the reminder-based intervention rather than baseline imbalance. The improvement in adherence score from 5.42 ± 1.28 to 7.86 ± 1.04 in the reminder device group was clinically meaningful, while the control group showed only modest improvement. Similarly, missed doses per week decreased markedly in the intervention group. This finding supports the concept that forgetfulness, irregular daily routines and poor medication-taking behaviour are important correctable causes of uncontrolled hypertension. Hypertension requires continuous pharmacological treatment, but patients often discontinue or miss drugs when symptoms are absent. Hamrahian et al. emphasized that medication non-adherence in hypertension is common, difficult to detect by routine clinical assessment and strongly associated with poor outcomes and increased healthcare burden [4]. In the present study, the reminder device acted as a simple behavioural support tool by repeatedly prompting the patient at the correct drug-taking time. This mechanism is consistent with the evidence that digital and reminder-based interventions improve adherence by strengthening memory, self-monitoring and patient engagement. Mikulski et al., in a systematic review and meta-analysis, reported that mobile health applications can improve medication adherence among patients with hypertension, although intervention designs and adherence measurement methods varied between studies [2]. Similarly, Yap et al. reported that digital health interventions, especially mHealth-based strategies, improved adherence and significantly reduced systolic and diastolic blood pressure among hypertensive patients [1]. Therefore, the present findings are consistent with recent evidence that technology-assisted reminders can improve adherence to long-term antihypertensive therapy.

The observed reduction in systolic and DBP was greater in the medication reminder device group than in the control group. The mean systolic blood pressure reduction was 14.94 ± 5.22 mmHg in the reminder device group compared with 7.26 ± 4.18 mmHg in the control group, while the mean diastolic

blood pressure reduction was 9.40 ± 3.16 mmHg compared with 4.36 ± 2.74 mmHg. Final blood pressure control was achieved in 72.5% of patients in the reminder device group compared with 40.0% in the control group. This suggests that better adherence translated into improved therapeutic response. The pharmacological effectiveness of antihypertensive drugs depends not only on drug selection, dose and combination therapy, but also on regular intake at prescribed intervals. Even an effective drug regimen may fail if the patient frequently misses doses. The SMART-BP randomized clinical trial showed that self-measured blood pressure supported by app-based feedback produced greater home systolic blood pressure reduction and higher medication adherence than self-measured blood pressure alone [5]. This supports the present observation that device-assisted follow-up and regular prompts may produce superior blood pressure outcomes compared with usual care. Solmaz and Altay also demonstrated that training combined with a medication reminder wristwatch improved treatment adherence in geriatric patients with hypertension [3]. Although the present study used a simple reminder device rather than a complex smartphone-based platform, the outcome was comparable in direction, suggesting that low-cost devices may be useful in routine practice, particularly in settings where advanced digital health systems may not be easily accessible. Li et al. also reported that home blood pressure monitoring was associated with blood pressure control and medication adherence in treated hypertensive patients, highlighting the value of patient participation in chronic disease monitoring [6]. Thus, combining pharmacological counselling with a practical device-based reminder may strengthen patient responsibility and improve long-term disease control.

The findings of this study have important interdisciplinary implications for Pharmacology and Medical Device research. From the pharmacology perspective, the study demonstrates that adherence is a key determinant of drug effectiveness in real-world hypertension management. From the medical device perspective, the reminder device functioned as a supportive tool to improve correct drug use, reduce missed doses and enhance patient satisfaction. The intervention was simple, non-invasive, low-cost and easy to implement. Such devices may be particularly useful in elderly patients, patients on multiple drugs, patients with twice-daily dosing schedules and those with a history of missed medication. Katz et al., in a systematic review and meta-analysis, found that digital health interventions improved blood pressure outcomes in populations experiencing health disparities, suggesting that technology-enabled support may be useful in reducing gaps in hypertension care [7]. However, the present study also had some limitations. The sample size was relatively small, the follow-up period was limited and adherence was partly assessed using self-reported measures, which may be affected by recall bias and social desirability bias. The study also did not compare different types of reminder devices, cost-effectiveness, long-term sustainability or adherence beyond the follow-up period. Despite these limitations, the results suggest that medication reminder devices can serve as an effective adjunct to routine prescription counselling. Future studies with larger sample size, longer follow-up, objective adherence monitoring and cost-benefit analysis are recommended. Overall, the study supports that a simple reminder device can significantly improve antihypertensive drug adherence and blood pressure control, making it a practical interdisciplinary model involving pharmacology, patient counselling and medical device innovation.

Conclusion: The study showed that use of a medication reminder device significantly improved antihypertensive drug adherence and blood pressure control compared with routine counselling alone. Patients using the device had better adherence scores, fewer missed doses, greater reduction in systolic and diastolic blood pressure, and higher final blood pressure control. The findings suggest that a simple reminder device can serve as a practical, low-cost pharmacology–medical device intervention to support long-term hypertension management.

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Table 1: Baseline characteristics of study participants

Variable	Control group	Test group	p value
Mean age, years	52.48 ± 8.94	53.15 ± 9.21	0.742
Male	23 (57.5%)	24 (60.0%)	0.819
Female	17 (42.5%)	16 (40.0%)	0.819
Hypertension duration*	5.21 ± 2.38	5.46 ± 2.51	0.648
Diabetes mellitus	12 (30.0%)	14 (35.0%)	0.633
Antihypertensives once **	26 (65.0%)	25 (62.5%)	0.816
Antihypertensives twice**	14 (35.0%)	15 (37.5%)	0.816
*in years; **daily			

Table 2: Comparison of medication adherence before and after intervention

Parameter	Control group	Test group	p value
Baseline adherence score	5.36 ± 1.31	5.42 ± 1.28	0.836
Final adherence score	6.18 ± 1.22	7.86 ± 1.04	<0.001
Mean improvement in adherence score	0.82 ± 0.74	2.44 ± 0.96	<0.001
Missed doses/week at baseline	3.15 ± 1.24	3.22 ± 1.18	0.796
Missed doses/week at final follow-up	2.08 ± 1.06	0.86 ± 0.72	<0.001
Good adherence at final follow-up	18 (45.0%)	32 (80.0%)	0.001

Table 3: Comparison of blood pressure before and after intervention

Parameter	Test group	Control group	p value
Baseline SBP	148.62 ± 9.84	149.18 ± 10.12	0.802
Final SBP	141.36 ± 8.92	134.24 ± 7.86	<0.001
Mean reduction in SBP	7.26 ± 4.18	14.94 ± 5.22	<0.001
Baseline DBP	92.48 ± 5.64	92.86 ± 5.72	0.765
Final DBP	88.12 ± 5.18	83.46 ± 4.92	<0.001
Mean reduction in DBP	4.36 ± 2.74	9.40 ± 3.16	<0.001
Controlled BP*	16 (40.0%)	29 (72.5%)	0.003
BP = Blood pressure; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; * at final follow-up			